PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H04M — A2

(11) International Publication Number: WO 00/39982

(43) International Publication Date: 6 July 2000 (06.07.00)

(21) International Application Number: PCT/US99/31089

(22) International Filing Date: 28 December 1999 (28.12.99)

(30) Priority Data:
09/222,746 29 December 1998 (29.12.98) US

(71) Applicant: ALCATEL USA SOURCING, L.P. [US/US]; 1000 Coit Road, Plano, TX 75075 (US).

(72) Inventor: SCHIER, John; 11748 DK Ranch Road, Austin, TX 78759 (US).

(74) Agent: LINTEL, Alan, W.; Anderson, Levine & Lintel, L.L.P., Suite 111, 12160 Abrams Road, Dallas, TX 75243 (US).

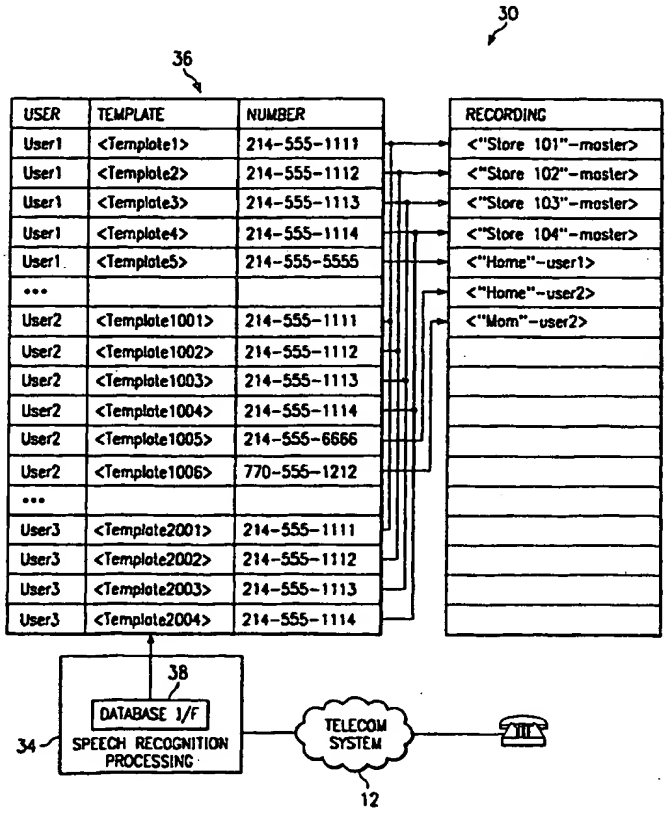
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: VOICE ACTIVATED DIALING WITH REDUCED STORAGE REQUIREMENTS

(57) Abstract

A voice activated dialing system (30) includes a database (36) maintaining a plurality of speech templates, associated telephone numbers, and recordings, wherein multiple speech templates can be linked to a single master recording. Processing circuitry (34) compares an utterance from a user to one or more of the templates from the database to find a matching template. When a match is found, the processing circuitry retrieves the telephone number associated with the matching template and the corresponding recording. The recording is replayed to the user prior to initiating a connection to the associated telephone number. Master recordings can be used for multiple entries which are associated with a single telephone number to reduce storage requirements.



Best Available Copy

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

BNSDOCID: <WO___0039982A2_I_>

VOICE ACTIVATED DIALING WITH REDUCED STORAGE REQUIREMENTS

BACKGROUND OF THE INVENTION

1. TECHNICAL FIELD

This invention relates in general to telecommunications and, more particularly, to voice activated dialing.

2. DESCRIPTION OF THE RELATED ART

Voice activated dialing has become a popular feature in many telephone systems. With voice activated dialing, a user can call a destination number without the need to look up the number or press any keys.

Typically, a caller can initiate a connection through a simple command such as "call the boss" or "call home." In this example, "call" is a command recognized by the voice activated dialing system (typically through speaker independent voice recognition) and "the boss" or "home" are destinations enrolled by the user. During enrollment, the user speaks the phrase which will be used to designate a destination and provides a number, either through the telephone keypad or by speaking the numbers into the phone (which are recognized using speaker independent voice recognition). The phrase is digitally recorded by the voice activated dialing system and is also reduced to a template (typically using linear predictive coding) for speech recognition purposes.

After enrollment, if the user initiates a call, for example, "call the boss", the system will compare the utterance with all the voice dialing templates associated

BNSDOCID: <WO__0039982A2_I_>

with that user to determine whether there is a match. If not, the system will ask the user to repeat the request. If a match is found, the system will respond with "calling the boss", where "the boss" is repeated in the users own voice using the recording stored along with the template during enrollment. This confirmation gives the user an opportunity to abandon the call if the voice activated system does not properly recognize the command.

While the confirmation is an important feature of the voice activated dialing system, since the matching process is not perfect and incorrect matches can occur, its cost in storage space and time is significant. While the template is fairly small, typically 1000 bytes or less, a compressed recording requires a significantly larger amount of storage in order to retain enough speech data to re-create an acceptable recording for playback. Consequently, the amount of storage required for large voice activated template directories is not very large, but it is very large for the corresponding recordings. Frequently, because of their size, the recordings are not stored on the system doing the recognition, but must be downloaded from another system. This introduces call setup delays which are annoying to users.

Naturally, this is a significant problem when large directories are used. The problem increases when longer utterances are recorded to accompany the templates. For a 1.5 second recording at 16,000 bits/sec, 24,000 bits or 3000 bytes are needed. For a higher quality recording at 64,000 bits/sec, 12000 bytes are necessary for the same recording.

While voice activated dialing should be encouraged to promote efficiency in the workplace, particularly when work includes calling a large number of numbers, the costs of storage can mean that workers must reduce their use of voice activated dialing. Typically, workers will eliminate the least used numbers from their voice activated dialing lists; it is these numbers that are the least likely to be memorized, requiring the workers to look up the numbers, which is inefficient.

Therefore a need has arisen for a voice activated dialing system for large dialing directories with reduced storage requirements.

BNSDOCID: <WO___0039982A2_I_>

BRIEF SUMMARY OF THE INVENTION

A voice activated dialing system includes a database maintaining a plurality of speech templates, associated telephone numbers, and recordings, wherein multiple speech templates can be linked to a single recording. Processing circuitry compares an utterance from a user to one or more of the templates from the database to find a matching template. When a match is found, the processing circuitry retrieves the telephone number associated with the matching template and the recording linked to the matching template. The recording is replayed to the user prior to initiating a connection to the associated telephone number.

The present invention provides significant advantages over the prior art. First, the storage requirements, and hence the cost, of the system can be greatly reduced because the number of recordings used in the system can be greatly reduced. Second, because the number of recordings is reduced, it is possible to store the recordings local to the processing circuitry, thereby increasing the responsiveness of the system.

BNSDOCID: <WO___0039982A2_I_>

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

Figure 1 illustrates a prior art structure for voice activated dialing;

Figure 2 illustrates a structure for voice activated dialing to reduce storage requirements and increase speed; and

Figure 3 illustrates a flow chart which could be used for enrollment using the voice activated dialing structure of Figure 2.

BNSDOCID: <WO___0039982A2_I_>

DETAILED DESCRIPTION OF THE INVENTION

The present invention is best understood in relation to Figures 1-3 of the drawings, like numerals being used for like elements of the various drawings.

Figure 1 illustrates a depiction of a prior art voice activated dialing system 10. It should be noted that this structure has been greatly simplified to show the important features for illustration purposes. The voice activated dialing system 10 is coupled to a telecommunications system 12 (which may be a local telephone system, a long distance carrier, private branch exchange (PBX), computer network or other system). The voice activated dialing system 10 includes processing circuitry 14 and database circuitry 16 (which may be a central database shared between multiple processing circuits 14). Processing circuitry 14 includes database interface circuitry 18 to communicate with the database circuitry 16.

The database circuitry 16 may be a centralized database or a distributed database. In a centralized database system, multiple processors 14 access a common database with information for all users in the common database. In a distributed database system, each processor has an associated database which contains a portion of the information of the overall database; if information is needed for a user which is not stored locally, it must be downloaded from another distributed database, or from a centralized backup database.

In operation, the voice activated dialing system 10 receives commands from users for dialing instructions. The commands, given verbally by users, are received by the processing circuitry 14, where the utterance is conditioned (typically into linear predictive coding vectors) and compared to the user's templates in database circuitry 16. It is assumed that the speaker's identity (for purposes of downloading the correct templates from the database circuitry 16) is known to the processing circuitry 14 either by the identity of the phone extension, a user logon, or other means. The templates are then compared with the linear predictive coding vectors derived from the utterance, and the closest match is found. The database circuitry 16 stores a corresponding telephone number and recording for each template, which are retrieved from database 16 to initiate the connection.

BNSDOCID <WO__ 0039982A2_I_>

As an illustrative example, assume that User2 initiates a voice activated dialing session by speaking "call store 102" into his phone. The processing circuitry 14 digitizes User2's speech and transforms it into LPC (linear predictive coding) vectors. These vectors are compared with all the templates for User2 in the database 16. If a match is found, the recording associated with the matching template is downloaded along with the telephone number associated with the matching template. In this example, the matching template should be <template 1002>. Thus, recording < "Store 102"-user2> should be downloaded along with the number "214-555-1112". The processing circuitry will announce "calling" and replay the recording <"Store 102"-user2>, which is the recording made from User2's voice at the time that User2 enrolled "Store 102" into the voice activated dialing system 10. Unless User2 aborts the call, the processing circuitry 14 will provide the dialing information to the telecommunications system 12 to initiate the connection to Store 102.

As shown in Figure 1, the one-to-one correspondence between templates and recordings causes the system 10 to have significant increases in storage requirements each time a new voice activated dialing entry is added, since each new entry adds a new digital recording. Further, there is a significant delay in initiating the connection if the recording has to be downloaded from another system.

Figure 2 illustrates a voice activated dialing system 30 which can dramatically decrease the amount of storage for voice activated dialing and which also increases the responsiveness of the system. As in Figure 1, the voice activated dialing system 30 is coupled to a telecommunications system 12 (which may be a local telephone system, a long distance carrier, private branch exchange (PBX), computer network or other system). The voice activated dialing system 30 includes processing circuitry 34 and database circuitry 36 (which may be shared between multiple VAD systems). Processing circuitry 34 includes database interface circuitry 38 to communicate with the database circuitry 36.

The voice activated dialing system 30 uses a many-to-one relationship between the templates and the recordings. Accordingly, when multiple users each have voice activated dialing entries for the same telephone number, the templates for

BNSDOCID: <WO___0039982A2_I_>

each user remain unique (as is necessary for proper speaker dependent speech recognition), but a single master recording for the telephone number is replayed during the confirmation stage. Accordingly, the number of digital recordings stored in the voice activated dialing system 30 is determined by the number of unique telephone numbers, rather than by the number of enrolled voice activated dialing entries.

Using the example set forth above, User2 once again initiates a voice activated dialing session by speaking "call store 102" into his phone. The processing circuitry 34 digitizes User2's speech and transforms it into LPC (linear predictive coding) vectors. These vectors are compared with all the templates for User2 in the database 36. If a match is found, the recording associated with the matching template is retrieved along with the telephone number associated with the matching template. In this example, the matching template should be <template 1002>, as in the example above. In this case, however, the recording <"Store 102"-master> is retrieved along with the number "214-555-1112". In many cases, the recordings for the overall database can be stored locally, due to the smaller storage requirements for the recordings. The processing circuitry will announce "calling" and replay the recording <"Store 102"-master>. Unless User2 aborts the call, the processing circuitry 34 will provide the dialing information to the telecommunications system 32 to initiate the connection to Store 102. In cases where the recordings, or at least the master recordings, are local to the processor 34, the confirming recording can be played almost immediately after the recognition.

If User 1 initiates a voice activated dialing session by speaking "call store 102" into her phone, the voice activated dialing system 30 digitizes User1's speech and transforms the utterance into LPC vectors to compare to User1's templates. After matching the utterance with template <Template2>, the system will once again retrieve the <"Store 102"-master> recording along with the telephone number "214-555-1212".

On the other hand, if User2 initiated a voice activated dialing session by stating "call home", the confirmation process would retrieve a unique recording

BNSDOCID: <WO___0039982A2_I_>

<"home-user2> for repeating to User2 prior to making the connection. If User1 initiated a voice activated dialing session by stating "call home", the confirmation process would retrieve a unique recording <"home-user1>. This is because the telephone numbers associated with the two voice activated dialing entries are different, even though the verbal command to initiate the voice activated dialing sessions is the same.

Accordingly, the voice activated dialing system 30 described above can greatly reduce storage requirements in certain situations where multiple callers each have entries for the same destination number. A situation like this would occur, for example, in a chain of stores where calls are frequently placed between the stores. It would also be useful in an office environment where each employee has voice activated dialing entries for a large number of the other employees, such that extension numbers do not need to be memorized.

Further, if the entire database can be stored locally, or if the recordings can be stored locally, the responsiveness of the system can be greatly enhanced. In some systems where there is not enough local storage to store all recordings locally, the master recordings may be stored locally for faster response in connection with the most frequently used recordings.

It should be noted that the master recordings are associated with the telephone numbers, not the command represented by the template. For example, User1 could refer to "Store 102" as "the Oklahoma store" in her voice activated dialing. To initiate a voice activated dialing to call "Store 102", User1 would say "call the Oklahoma store" and the voice activated dialing system 10, after correctly matching the utterance to template <Template2>, would respond with "Calling Store 102", where "Store 102" was recorded in <"Store 102-master">. Thus, the command used by an individual can vary from the recording used in the confirmation process.

The making of a master recording, i.e., a recording associated with two or more voice activated dialing entries, can be done in a number of ways. One way would be to notify the system administrator when redundant entries (multiple

BNSDOCID: <WO___0039982A2_I_>

entries to the same telephone number) were found in the database 36. The system administrator could then make a master recording to which each of the redundant entries would be linked through the database 36.

A second method of enrolling new entries is shown in Figure 3. In block 50, processing circuitry 34 identifies the user and prompts the user for a new voice activated dialing entry. In block 52, the entry spoken by the user is received and recorded and the telephone number associated with the entry is entered by the user, either by voice commands or the touch tone keypad. In decision block 54, the processing circuitry 34 searches the database 36 for other references to the telephone number entered by the user. If no redundant entries are detected, the recording is saved in the database 36 and linked to the entry in block 56. On the other hand, if the processing circuitry 34 detects on or more references to the telephone number entered by the user, it links the entry to the previously enrolled entry in block 60. At a later time, the recording could then be changed, if desired, by authorized personnel.

The storage savings can be significant. In a system where 1000 users frequently call the same 2000 destinations, there would be up to 2000 templates for each of 1000 users, plus up to 2000 recordings for each of 1000 users. The template size, assuming use of a 1000 byte template, would be 1000 users X 2000 templates/user X 1000 bytes/template, or 2 gigabytes of template information. Even with speech compression, the size of the confirming recordings would be approximately 1000 users X 2000 recordings/user X 16,000 bit/sec X 1.5 sec/recording X 1 byte/8 bits, or 6 gigabytes. If the recording was performed at 64k bits per second, the require recording storage would be 24 gigabytes. By reducing the 2 million recordings to 2000 recordings by using shared master recordings, the storage requirements could be reduced by a factor of 1000 to 6 megabytes (24 megabytes for 64 kbit/sec recordings). This relatively small amount of storage can easily be accommodated locally. The templates, which are significantly smaller, can be stored locally if possible or centrally if necessary.

BNSDOCID: <WO__0039982A2_I_>

The present invention provides several advantages over the prior art. First, in many situations, the number of recordings stored on the system can be greatly reduced, thus reducing storage requirement and, consequently, the cost of the voice activated dialing. Second, since the recording storage is greatly reduced, the recordings can be maintained locally, increasing the speed of retrieval and the responsiveness of the system.

Although the Detailed Description of the invention has been directed to certain exemplary embodiments, various modifications of these embodiments, as well as alternative embodiments, will be suggested to those skilled in the art. The invention encompasses any modifications or alternative embodiments that fall within the scope of the Claims.

BNSDOCID: <WO___0039982A2_I_>

CLAIMS

1. A voice activated dialing system, comprising:

a database including a plurality of speech templates, associated telephone numbers, and recordings, wherein multiple speech templates can be linked to a single recording; and

processing circuitry for:

comparing an utterance to one or more of said templates from said database to determine a matching template;

retrieving the telephone number associated with the matching template;

retrieving the recording linked to the matching template; and

replaying said recording to the user prior to initiating a connection to said associated telephone number.

2. The voice activated dialing system of claim 1 wherein said recordings are stored local to the processing circuitry.

3. The voice activated dialing system of claim 1 wherein said templates are stored local to the processing circuitry.

4. The voice activated dialing system of claim 1 wherein said templates are stored in a centralized database.

5. The voice activated dialing system of claim 1 wherein said processing circuitry identifies multiple associations of multiple templates to a common telephone number.

6. A method of performing voice activated dialing, comprising the steps of:

storing a plurality of speech templates, associated telephone numbers, and associated recordings, wherein multiple speech templates can be linked to a single recording; and

comparing an utterance to one or more of said templates from said database in a processor using speech recognition techniques to determine a matching template;

BNSDOCID: <WO__0039982A2_I_>

retrieving the telephone number associated with the matching template;

retrieving the recording linked to the matching template; and

replaying said recording to the user prior to initiating a connection to said associated telephone number.

7. The method of claim 6 wherein said storing step includes the step of storing recordings local to the processing circuitry.

8. The method of claim 6 wherein said storing step includes the step of storing templates local to the processing circuitry.

9. The method of claim 6 wherein said storing step includes the step of storing templates in a centralized database.

10. The method of claim 6 and further comprising the step of identifying multiple associations of multiple templates to a common telephone number.

11. The method of claim 10 wherein said identifying step comprises the step of receiving a telephone number from a user during enrollment of a new voice activated dialing entry and comparing the telephone number to other of said telephone numbers.

BNSDOCID: <WO___0039982A2_I_>

FIG. 1
(PRIOR ART)

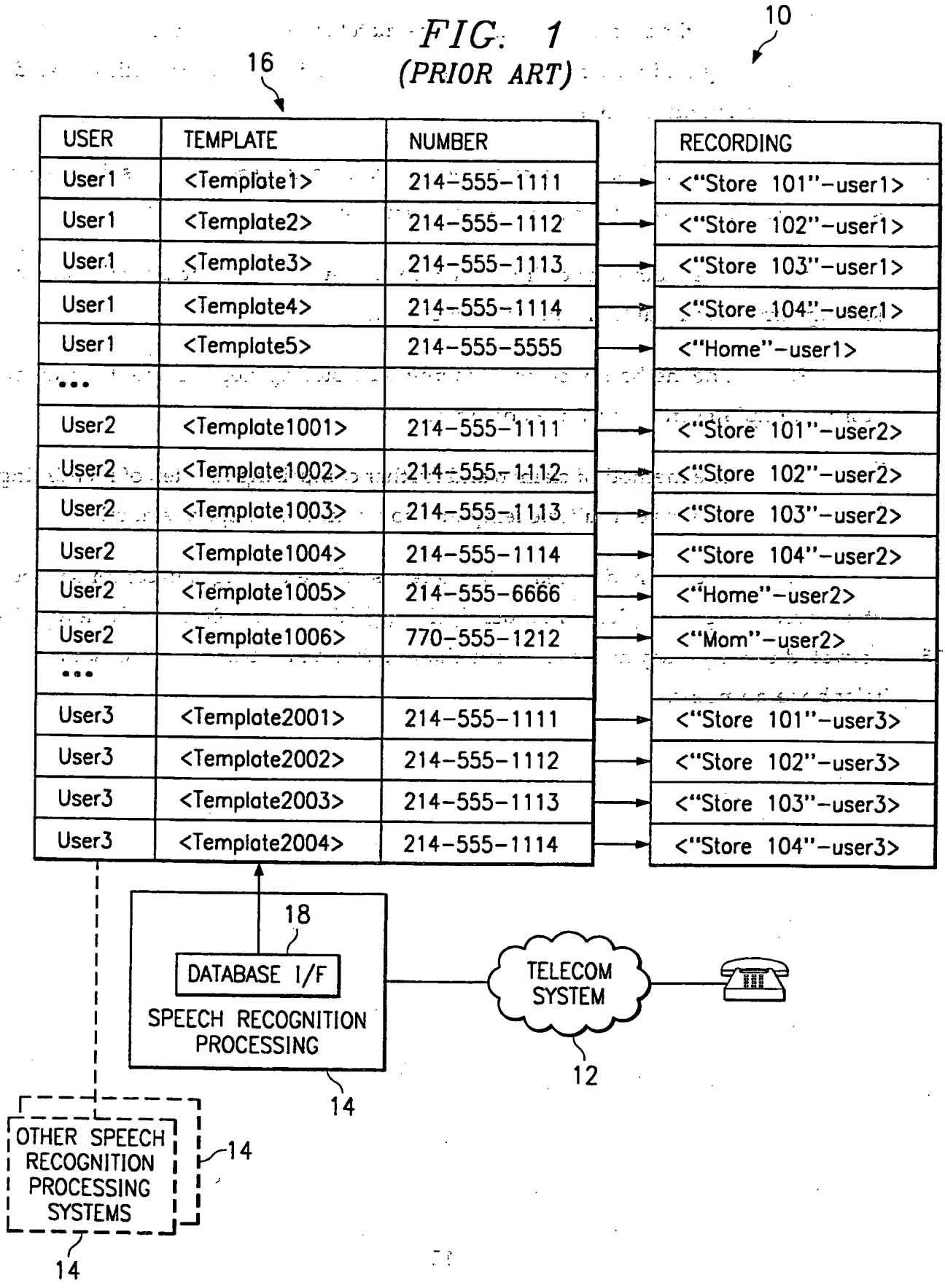


FIG. 2

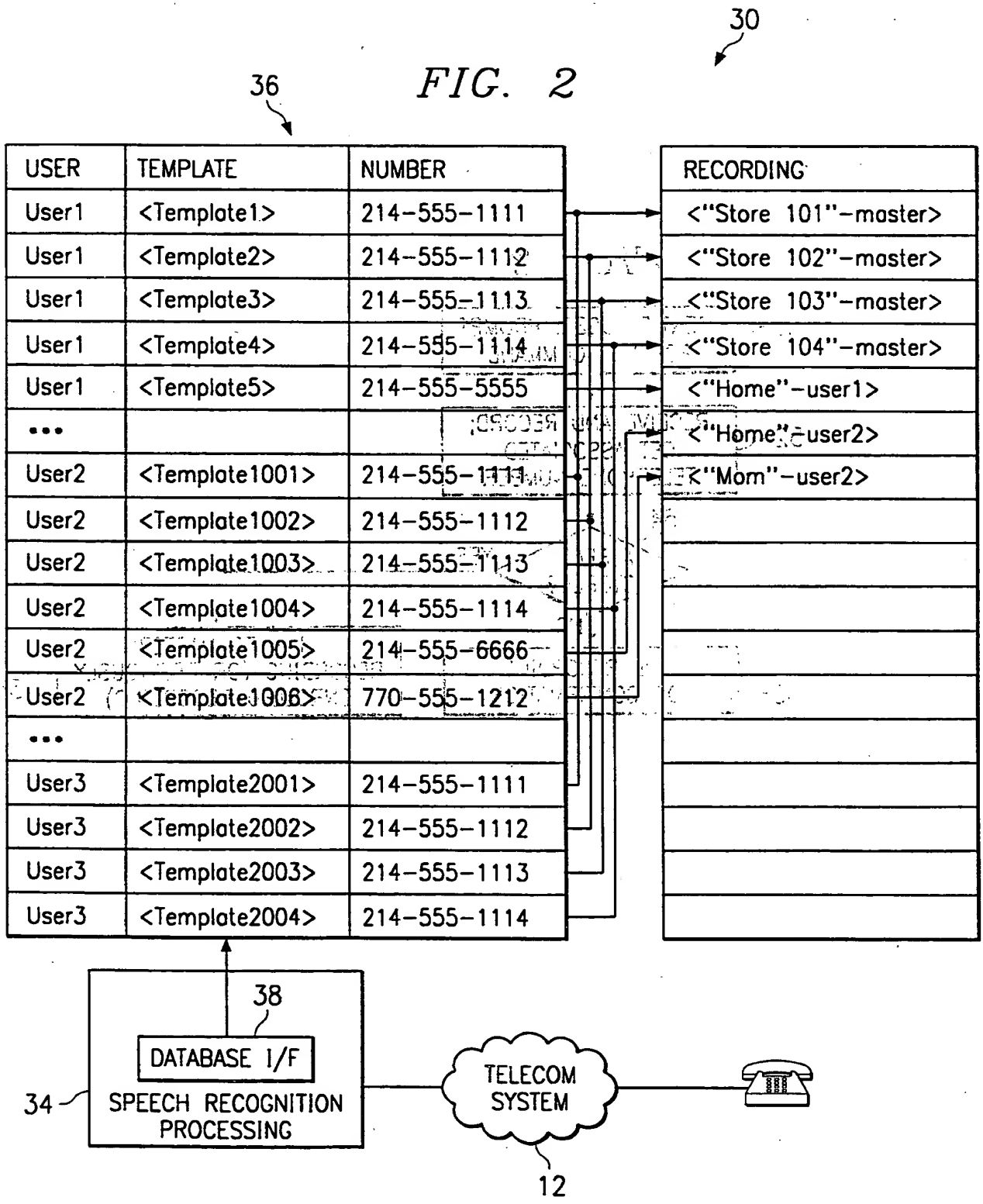
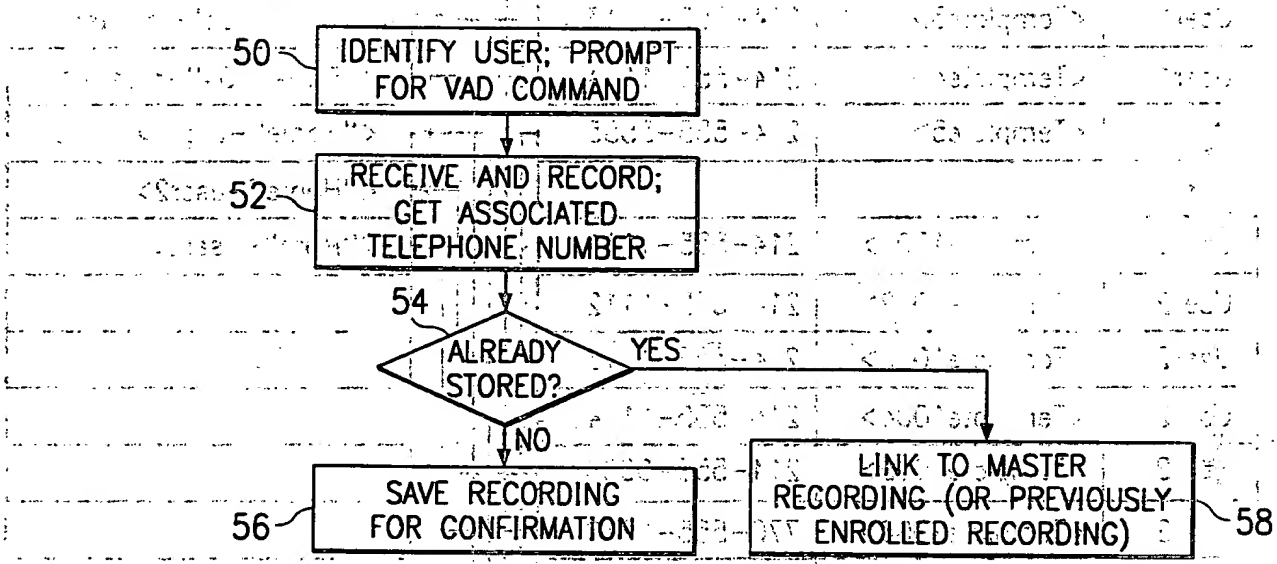

30
36
USER
TEMPLATE
NUMBER
RECORDING
User1 <Template1> 214-555-1111 <"Store 101"-master>
User1 <Template2> 214-555-1112 <"Store 102"-master>
User1 <Template3> 214-555-1113 <"Store 103"-master>
User1 <Template4> 214-555-1114 <"Store 104"-master>
User1 <Template5> 214-555-5555 <"Home"-user1>
... <"Home"-user2>
User2 <Template1001> 214-555-1111 <"Mom"-user2>
User2 <Template1002> 214-555-1112
User2 <Template1003> 214-555-1113
User2 <Template1004> 214-555-1114
User2 <Template1005> 214-555-6666
User2 <Template1006> 770-555-1212
...
User3 <Template2001> 214-555-1111
User3 <Template2002> 214-555-1112
User3 <Template2003> 214-555-1113
User3 <Template2004> 214-555-1114
38
DATABASE I/F
34
SPEECH RECOGNITION PROCESSING
TELECOM SYSTEM
12

FIG. 3



BNSDOCID: <WO___0039982A2_I_>

This Page Blank (uspto)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 July 2000 (06.07.2000)

PCT

(10) International Publication Number
WO 00/39982 A3

(51) International Patent Classification[7]: H04M 1/27

(21) International Application Number: PCT/US99/31089

(22) International Filing Date:
28 December 1999 (28.12.1999)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/222,746 29 December 1998 (29.12.1998) US

(71) Applicant: ALCATEL USA SOURCING, L.P. [US/US]; 1000 Coit Road, Plano, TX 75075 (US).

(72) Inventor: SCHIER, John; 11748 DK Ranch Road, Austin, TX 78759 (US).

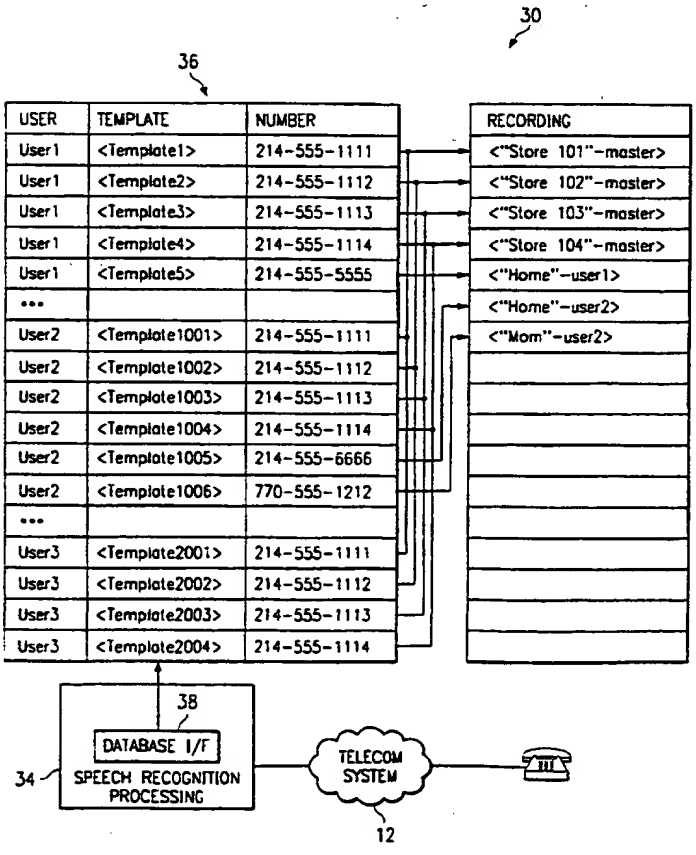
(74) Agent: LINTEL, Alan, W.; Anderson, Levine & Lintel, L.L.P., Suite 111, 12160 Abrams Road, Dallas, TX 75243 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: VOICE ACTIVATED DIALING WITH REDUCED STORAGE REQUIREMENTS



(57) Abstract: A voice activated dialing system (30) includes a database (36) maintaining a plurality of speech templates, associated telephone numbers, and recordings, wherein multiple speech templates can be linked to a single master recording. Processing circuitry (34) compares an utterance from a user to one or more of the templates from the database to find a matching template. When a match is found, the processing circuitry retrieves the telephone number associated with the matching template and the corresponding recording. The recording is replayed to the user prior to initiating a connection to the associated telephone number. Master recordings can be used for multiple entries which are associated with a single telephone number to reduce storage requirements.

WO 00/39982 A3

BNSDOCID: <WO___0039982A3_I_>

Published:

— *With international search report.*

— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(88) Date of publication of the international search report:
18 January 2001

BNSDOCID: <WO___0039982A3_I_>

INTERNATIONAL SEARCH REPORT

Internr ·al Application No
PCT/US 99/31089

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M1/27

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 762 709 A (TEXAS INSTRUMENTS INC) 12 March 1997 (1997-03-12) abstract column 2, line 29 -column 3, line 42 column 6, line 11-18 figures 1-5,7	1-3,5-8, 10,11
Y	---	4,9
Y	EP 0 477 688 A (TEXAS INSTRUMENTS INC) 1 April 1992 (1992-04-01) abstract figure 2	4,9

A	EP 0 866 595 A (ERICSSON TELEFON AB L M) 23 September 1998 (1998-09-23) abstract column 2, line 21 -column 4, line 13 figures 1-5	1,6

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 October 2000	06/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Golzio, D

1

Form PCT/ISA/210 (second sheet) (July 1992)

BNSDOCID: <WO__0039982A3_I_>

INTERNATIONAL SEARCH REPORT

Internal Application No
PCT/US 99/31089

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 832 063 A (VYSOTSKY GEORGE J ET AL) 3 November 1998 (1998-11-03) figure 1	1,6

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

BNSDOCID. <WO___0039982A3_I_>

INTERNATIONAL SEARCH REPORT

...ormation on patent family members

Interna...al Application No
PCT/US 99/31089

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0762709 A	12-03-1997	CA 2185262 A	13-03-1997
		JP 9205478 A	05-08-1997
EP 0477688 A	01-04-1992	US 5165095 A	17-11-1992
		DE 69129883 D	03-09-1998
		DE 69129883 T	25-02-1999
		JP 6085893 A	25-03-1994
EP 0866595 A	23-09-1998	GB 2323497 A	23-09-1998
		AU 5843998 A	24-09-1998
		NO 981075 A	21-09-1998
US 5832063 A	03-11-1998	US 5719921 A	17-02-1998
		US 6076054 A	13-06-2000
		US 5895448 A	20-04-1999
		US 5842165 A	24-11-1998

BNSDOCID: <WO___0039982A3_I_>

This Page Blank (uspto)

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☑ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☑ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

THIS PAGE BLANK (USPTO)